

REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested. Claims 1-9, 11, 13, 15, 18-21, 26, 28 and 30-43 remain pending.

Claim 1 is objected to because the Examiner believes "it is unclear how one motion sensor could detect motion in six degrees of freedom." Furthermore, claims 1-9, 11, 13, 18-21, 26-28, 30-35 and 37-43 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,366,831 to Raab. Claims 15 and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Raab in view of Davis, of record. These rejections and objection are respectfully traversed.

Specifically, concerning the objection to claim 1, as discussed in more detail below, Applicants submit that a motion sensor capable of measuring six degrees of freedom is described in the present application. Furthermore, concerning the art-based rejections, Applicants respectfully submit that the machine taught by Raab does not measure separations or distances, but rather, monitors coordinates and orientation for the purposes of emulation. Also, the Raab machine does not perform "error correction" as claimed. Furthermore, Applicants respectfully submit that the machine taught by Raab is not "portable" in use and instead requires a stand.

The objection and rejections will now be discussed in more detail.

Objection to Claim 1

Applicants respectfully submit that the present application, in particular, page 4, line 23 through page 5, line 5, describes a single solid-state inertial measuring unit (commonly referred to as an IMU) that is capable of monitoring motion in six degrees of freedom. Applicants also refer

the Examiner to the website ieeexplore.ieee.org which provides brief details on the function of an IMU, referred to as the MotionPak™, which is a “six degree of freedom ... motion sensor”. A printout of this information is being attached as Exhibit 1 for the Examiner’s convenience. Thus, although the solid-state measuring unit may comprise more than one sensor, it is itself also referred to as a sensor, in the singular. The claims of the present application therefore read on an arrangement where a single IMU is used to obtain motion information in six degrees of freedom, and also an arrangement where a group of individual motion sensors that each provide information on only one or more axes are employed collectively to generate information in six degrees of freedom.

For at least these reasons, Applicants respectfully request that the Examiner withdraw this objection.

The 35 U.S.C. §§ 102(e) and 103 Rejections

In the 102(e) rejection, the Examiner contends that Raab teaches each and every feature of claims 1-9, 11, 13, 18-21, 26-28, 30-35 and 37-43. Applicants respectfully disagree, and will now address the contentions made by the Examiner in the various subparagraphs set forth on pages 4-5 of the Office Action.

Sub paragraph a)

Applicants respectfully submit that Raab teaches a coordinate measuring machine (CMM) and a method for programming the tool path of a multi-axis machine tool (see col.1, lines 16-22).

For this purpose, the coordinate measuring machine of Raab is specifically adapted to monitor the individual movements associated with six separate joints so that these movements may be replicated precisely by a machine tool or robot. The section identified by the Examiner at column 13, lines 13-36 of Raab provides details of how orientation data is generated through monitoring the movements of an articulated arm for the purposes of programming a machine tool to replicate those movements.

As a result of the function and intended purpose of the coordinate measuring machine described in Raab, the coordinate measuring machine is not “adapted to provide a measure of a relative spatial separation,” nor does Raab teach the possibility of such a measurement being made. In the Raab machine, only the movements of each joint individually are recorded, and no single position is monitored in six degrees of freedom, nor is such a position then compared with a further position to calculate a relative spatial separation. Furthermore, since the coordinate measuring machine of Raab does not teach measuring spatial separation, its display is not adapted to present information on a measured relative spatial separation. Additionally, the processor of the coordinate measuring machine of Raab is not adapted to “determine at least one angle of a second location with reference to a line or plane incorporating said first location.” Rather, only the movements of individual joints are recorded solely for the purpose of those movements being replicated by a machine tool or robot.

In addition, Raab fails to teach any mathematical manipulation of the monitored movements for the purpose of generating a measurement of spatial separation either linearly or an angle. Finally, with regard to claim 1, Raab does not teach *determining an error correction*. The section of Raab referred to by the Examiner relates to smoothing of the recorded data to account for jitter.

Raab is completely silent on how the smoothing is performed, but in this context, smoothing may involve simply the *removal* of movement measurements which exceed permitted variations.

Sub paragraph b)

Applicants respectfully submit that Raab does not teach a processor which is “adapted to determine at least one angle with respect to one or both of vertical and horizontal planes.” Since the coordinate measuring machine taught by Raab is simply required to provide coordinate data to enable a machine tool or robot to emulate the movements, there is no need for the Raab machine to determine an angular measurement with respect to either vertical or horizontal planes. The fact that Raab describes measuring movement in six degrees of freedom means that the movement measurements are made in the coordinate space of the machine and not with respect to either vertical or horizontal planes.

Sub paragraph c)

Applicants submit that Raab does not teach a processor adapted to determine whether first and second locations are level with respect to either of horizontal or vertical planes. Since the coordinate measuring machine of Raab is simply required to provide coordinate data to enable a machine tool or robot to emulate the movements, there is no need for the Raab machine to determine whether locations are level with respect to horizontal or vertical planes. The fact that Raab describes measuring movement in six degrees of freedom means that the movement

measurements are made in the coordinate space of the machine and not with respect to either vertical or horizontal planes.

Sub paragraph d)

Applicants submit that Raab does not teach a processor adapted to determine a linear distance separating first and second locations. Raab only describes monitoring movements for the purpose of emulating the movements, which does not require any measurement or calculation of linear separation.

Sub paragraph g)

Applicants submit that Raab does not teach a processor adapted to determine an error correction in relation to motion detected by one or more motion sensors when a measuring point is aligned with a selected location and is substantially stationary. The section of Raab referred to by the Examiner relates to the smoothing of the recorded data to account for jitter. Raab is completely silent on how the smoothing is performed, but in this context, smoothing may involve simply the *removal* of movement measurements which exceed permitted variations. In any event, smoothing is inherently smoothing with respect to a series of measurements *during movement* and not determining an error correction when a measuring point is *substantially stationary* as claimed.

On the other hand, the “error correction” performed by the claimed embodiments of the present application corrects for errors in the *output* of the motion sensors arising, for example,

from drift and or thermal effects, and not the jitter arising from manual manipulation as would occur with the articulated arm taught by Raab.

Sub paragraph h)

Applicants respectfully submit that Raab does not teach the updating of calibration data stored in a memory. Although Raab makes reference to calibration data, this data is recorded only once and there is no provision in Raab for the calibration data to be updated during use.

Sub paragraph i)

As mentioned above, Raab does not teach the updating of calibration data stored in a memory during use. Raab only describes an initial recording of calibration data, and there is no teaching of updating the data.

Sub paragraph j)

Applicants respectfully submit that Raab does not teach the use of a timer for monitoring the time duration of a measurement. The reference in the Office Action to column 3, lines 10-14 of Raab pertains to the capture and transmission of data not with monitoring the duration of time during which data is collected. Furthermore, Raab does not teach a processor adapted to determine a measure of relative spatial separation for the reasons discussed above, and also, Raab does not teach a processor capable of adjusting the resolution of its measurements with respect to time duration.

Sub paragraph k)

Applicants submit that Raab does not teach the generation of an error correction as claimed. Rather, Raab teaches the smoothing of movement data with respect to hand jitter. The smoothing need not involve any error correction calculation, and may simply involve the omission of measurements which do not meet predetermined criteria. Furthermore, Raab does not teach determining an error correction when the machine is stationary. Instead, smoothing of movement data is performed with respect of movement data generated when the articulated arm is being held and is being moved.

Sub paragraph l)

Although Raab may in some respects describe smoothing the movement measurements with respect to jitter, Raab does not teach or suggest how the smoothing is performed. Hence, Applicants submit that there is no teaching in Raab of the use of threshold limits for accommodating uncontrolled hand movements.

Sub paragraph m)

Applicants submit that Raab does not describe a deceleration device for use during the identification of locations for the purposes of spatial separation and angular measurement by the device. Instead, column 8, lines 3-8 of Raab states that the shock absorber 134 is used to accommodate shock only when the articulated arm is being repositioned into its storage position.

Sub paragraph n)

Applicants submit that Raab does not teach the supply to the display of “real time” data in the form of spatial separation and angular measurements. Instead, the section of Raab relied upon by the Examiner pertains to the storage of collected coordinate and orientation data in a memory. There is no suggestion in Raab that this data is or is representative of spatial or angular separation, and the coordinate measuring machine taught by Raab is not intended to make such measurements. Rather the Raab machine is intended solely to enable the coordinates and orientation of the articulated arm to be emulated by a machine tool or robot.

Sub paragraph o)

Applicants submit that Raab does not teach the updating of calibration data or the storage of updated calibration data. Raab also fails to teach the calculation of error corrections or the storage of such error corrections.

Sub paragraph p)

Raab teaches a connector suitable for connection to a “laser scanning tool”. Applicants submit that the coordinate measuring machine described in Raab generates coordinate data for the purposes of a machine tool or robot emulating the movements, and thus, there is nothing in Raab to teach or suggest that the laser scanning machine referred to therein is a measuring tool. Rather, the laser scanning tool is a product bar code reader so that movement coordinates

recorded by the coordinate measurement machine can be correlated automatically with the product which is to be machined.

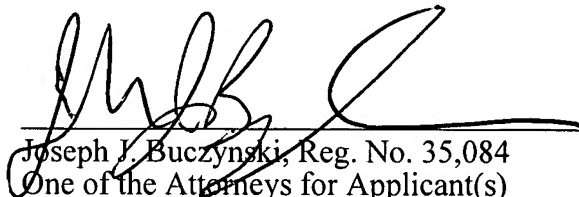
Applicants further respectfully submit that at least all of the above arguments are relevant with respect to the other rejected claims. Namely, unlike the claimed embodiments of the present invention, Raab teaches a machine which records instantaneous coordinate and orientation positions for the purposes of a machine tool emulating these positions. There is therefore no teaching of the measurement of longitudinal, lateral or angular separation. Moreover, the generation of such measurements cannot be deemed obvious from Raab, as such measurements have no relevance with respect to the intended purpose of the machine.

With regard to the rejection of dependent claims 15 and 36, Applicants respectfully submit that the teachings of Davis fail to make up for the deficiencies in the teachings of Raab as discussed above to have rendered obvious to one skilled in the art the embodiments of the present invention even as recited in the independent claims. Hence, for at least the above reasons, all claims should be allowable.

Appl. No. 10/534,639
Response dated October 9, 2007
Reply to second Final Office Action of August 6, 2007

In view of the above, it is believed that the application is in condition for allowance and notice to this effect is respectfully requested. Should the Examiner have any questions, the Examiner is invited to contact the undersigned at the telephone number indicated below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'J. Buczynski', with a long horizontal flourish extending to the right.

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